REFERENCE TABLES

Abbreviations of Some Units of Measurement

acre	A	inch	in
centigram	cg	kilogram	kg
centiliter	cl	kiloliter	kl
centimeter	cm	kilometer	km
cubic centimeter	cc	liter	l
decigram	dg	meter	m
deciliter	dl	mile	mi
decimeter	dm	milligram	mg
dekagram	dkg	milliliter	ml
dekaliter	dkl	millimeter	mm
dekameter	dkm	nanometer	nm
foot	ft	ounce	oz
gallon	gal	parts per million	ppm
gram	g	pound	lb
hectare	ha	tablespoon	tbsp
hectogram	hg	teaspoon	tsp
hectoliter	hl	yard	yd
hectometer	hm		

Metric System Prefixes and Relationships

Prefix	Meaning	Decimal	Fraction	Power of 10
kilo-	one thousand	1000.	$\frac{1,000}{1}$	10^3
hecto-	one hundred	100.	$\frac{100}{1}$	10^2
deka-	ten	10.	$\frac{10}{1}$	10^1
…	one	1.	…	…
deci-	one-tenth	0.1	$\frac{1}{10}$	10^{-1}
centi-	one-hundredth	0.01	$\frac{1}{100}$	10^{-2}
milli-	one-thousandth	0.001	$\frac{1}{1,000}$	10^{-3}
micro-	one-millionth	0.000001	$\frac{1}{1,000,000}$	10^{-6}
nano-	one-billionth	0.000000001	$\frac{1}{1,000,000,000}$	10^{-9}
pico-	one-trillionth	0.000000000001	$\frac{1}{1,000,000,000,000}$	10^{-12}

Weight of Powder Required to Prepare a Given Amount of Spray Mixture at a Given Dosage

Recommended Dosage/100 gal			Weight of Powder Required to Prepare Spray Mixture										
			50 gal		20 gal		10 gal		5 gal		1 gal	
lb	oz	g	oz	g	oz	g	oz	g	oz	g	oz	g
0.25	4	113	2	56	0.8	23	0.4	11	0.2	6	0.04	1
0.5	8	227	4	113	1.6	45	0.8	23	0.4	11	0.08	2
1	16	454	8	227	3.2	91	1.6	45	0.8	23	0.16	5
1.5	24	681	12	340	4.8	136	2.4	68	1.2	34	0.24	7
2	32	908	16	454	6.4	182	3.2	91	1.6	45	0.32	9
3	48	136	224	681	9.6	272	4.8	136	2.4	68	0.48	14
4	64	1816	32	908	12.8	363	6.4	182	3.2	91	0.64	18
5	80	2270	40	1135	16	454	8	227	4	113	0.8	23

Volume of Liquid Required to Prepare a Given Amount of Spray Mixture at a Given Dilution

Dilution of Spray Required	Recommended Dosage/100 gal			Volume of Liquid Required to Prepare Spray Mixture									
				50 gal		20 gal		10 gal		5 gal		1 gal	
	cup	pint	quart	pint	cc	pint	cc	cc	tsp	cc	tsp	cc	tsp
1:3200	0.5	0.25	0.12	0.125	59.15	0.05	23.7	11.8	2.4	5.9	1.2	1.18	0.2
1:1600	1	0.5	0.25	0.25	118.3	0.1	47.7	23.7	4.8	11.9	2.4	2.37	0.5
1:800	2	1	0.5	0.5	236.6	0.2	94.6	47.3	9.6	23.7	4.8	4.73	1
1:400	4	2	1	1	473.2	0.4	189.3	94.6	19.2	47.3	9.6	9.46	1.9
1:200	8	4	2	2	946.4	0.8	378.6	189.3	38.3	94.6	19.2	18.93	3.8
1:100	16	8	4	4	1892.8	1.6	757.1	378.6	76.6	189.3	38.3	37.86	7.7
1:50	32	16	8	8	3785.6	3.2	1514.2	757.2	153.2	378.6	76.6	75.71	15.3
1:25	64	32	16	16	7571.2	6.4	3028.5	1514.2	306.4	757.1	153.7	151.42	30.6

Constants and Conversions Used in Spray Applications

Use the following formula, sometimes called the criss-cross dilution method, to dilute concentrate material to a given degree. Let:

- A = percentage strength of solution to be diluted
- B = percentage strength of solution used for diluting (water = zero)
- W = percentage strength desired
- X = W minus B
- Y = A minus W

The formula is:

$W = X$ parts of A + Y parts of B

Example 1

A surface disinfectant concentrate contains 89% active ingredient, but the recommendation for a particular use is for a 30% solution. W = 30 and B = 0; thus X (which is W − B) = 30 parts of the concentrate and A = 89 and W = 30; thus Y (which is A − W) = 59 parts of the dilutant

Answer: Mix 30 parts of concentrate with 59 parts of dilutant.

Example 2

A grower has some soil drench containing 27% active ingredient and some concentrate containing 93%. The need at the moment, however, is for a 45% solution. W = 45 and B = 27; thus X (W − B) = 18 parts of the 93% concentrate and A = 93 and W = 45; thus Y (A − W) = 48 parts of the 27% diluted drench

Answer: Mix 18 parts of concentrate with 48 parts of dilute drench.

Spray Concentration Conversions

oz/100 gal	ppm	% Solution	g/100 l
0.66	50	0.005	5
1	75	0.0075	7.5
1.33	100	0.01	10
2 (0.125 lb)	150	0.015	15
2.66	200	0.02	20
3.33	250	0.025	25
4 (0.25 lb)	300	0.03	30
5.33	400	0.04	40
6.66	500	0.05	50
8 (0.5 lb)	600	0.06	60
9.33	700	0.07	70
10.66	800	0.08	80
12 (0.75 lb)	900	0.09	90
13.33	1,000	0.1	100
16 (1 lb)	1,200	0.12	120
20 (1.25 lb)	1,500	0.15	150
24 (1.5 lb)	1,800	0.18	180

Weight–Volume Conversions

1 g per	= Parts per Million (ppm)	% Dilution
1,000 ml (1 liter)	1,000	0.1
10 l	100	0.01
100 l	10	0.001
1,000 l	1	0.0001
10,000 l	0.1	
100,000 l	0.01	
1,000,000 l	0.001 (= 1 ppb)	

Approximately Equivalent Application Rates (U.S. measures)

1 oz/sq ft	=	2,722.5 lb/A
1 oz/sq yd	=	302.5 lb/A
1 oz/100 sq ft	=	27.2 lb/A
1 lb/100 sq ft	=	435.6 lb/A
1 lb/1,000 sq ft	=	43.6 lb/A
1 lb/A	=	0.33 oz/1,000 sq ft
5 gal/A	=	1 pint/1,000 sq ft
100 gal/A	=	2.5 gal/1,000 sq ft
100 gal/A	=	1 quart/100 sq ft

Conversion Rates for Small Areas

Rate/A	Rate/1,000 sq ft	Rate/100 sq ft
	Liquid Materials	
1 pint	0.75 tbsp	0.25 tsp
1 quart	1.5 tbsp	0.5 tsp
1 gal	6 tbsp	2 tsp
25 gal	4.5 pints	1 cup
50 gal	4.5 quarts	1 pint
75 gal	6.5 quarts	1.5 pints
100 gal	9 quarts	1 quart
	Dry Materials	
1 lb	2.5 tsp	0.25 tsp
3 lb	2.25 tbsp	0.75 tsp
4 lb	3 tbsp	1 tsp
5 lb	0.25 cup	1.25 tsp
6 lb	4.5 tbsp	1.5 tsp
8 lb	6 tbsp	1.75 tsp
10 lb	0.5 cup	2 tsp
100 lb	2.25 lb	0.25 lb

Volume Equivalents

Measuring Unit Used	Number of Units Needed to Fill Measure in Column 1					
	tsp	tbsp	cup	pint	cc	liter
1 tsp	1	0.33	0.021	0.01	4.9	0.0049
1 tbsp	3	1	0.663	0.031	14.8	0.0148
1 fl oz	6	2	0.125	0.062	29.6	0.0296
1 cup	48	16	1	0.5	236.6	0.2366
1 pint	96	32	2	1	473.2	0.4732
1 quart	192	64	4	2	946.3	0.9463
1 gal	768	256	16	8	3785.3	3.7853
1 liter	202.88	67.63	4.328	2.164	1000	1
1 ml (1 cc)	0.2	0.068	0.0042	0.0021	1	0.001

Other Equivalents

Linear		Area		Mass	
1 cm	0.3937 in	1 sq cm	0.155 sq in	1 g	0.0353 oz
1 m	100 cm	1 sq m	10,000 sq cm	1 g	1,000 m
1 m	39.37 in	1 sq m	10.764 sq ft	1 g	0.001 kg
1 m	3.28 ft	1 sq m	1.196 sq yd	1 kg	35.274 oz
1 m	1.094 yd	1 sq in	6.451 sq cm	1 kg	2.2046 lb
1 in	2.54 cm	1 sq ft	929.01 sq cm	1 oz	28.349 g
1 ft	30.48 cm	1 sq yd	8,361.3 sq cm	1 lb	453.59 g
1 ft	12 in	1 sq yd	0.836 sq m	1 lb	16 oz
1 ft	0.333 yd	1 sq yd	9 sq ft	1 lb	0.4535 kg
1 yd	36 in	1 sq yd	1,296 sq in	1 ton	2,000 lb
1 yd	3 ft	1 ha	2.471 A	1 ton	906.8 kgrams
1 yd	91.44 cm	1 ha	10,000 sq m		
1 yd	9.14 m	1 ha	107,640 sq ft		
1 rod	5.029 m	1 A	0.405 ha		
1 rod	5.5 yd	1 A	4,046.8 sq m		
1 rod	16.5 ft	1 A	4,840 sq yd		
1 km	1,000 m	1 A	43,560 sq ft		
1 km	0.621 mi	1 A	160 sq rods		
1 mi	1.609 km	1 sq mi	259.2 ha		
1 mi	1,760 yd	1 sq mi	640 A		
1 mi	5,280 ft				
1 mi	329 rods				

Trees per Acre and Trees Passed per Minute

G.E. PAGE, Agricultural Engineering Department, OSU

Tree Spacing (ft)	10	12	16	20	25	30	35	40
Trees/A	435.2	302.5	170	108.9	69.7	48.4	35.6	27.2
Trees/min at								
1 mph	8.8	7.3	5.5	4.4	3.5	2.9	2.5	2.2
1.5 mph	13.2	11	8.2	6.6	5.3	4.4	3.8	3.3
2 mph	17.6	14.6	11	8.8	7	5.9	5	4.4
2.5 mph	22	18.3	13.7	11	8.8	7.3	6.3	5.5
3 mph	26.4	22	16.5	13.2	10.6	8.8	7.5	6.6

Conversion Factors

To Change	To	Multiply by
bushels per acre	hectoliters per hectare	0.87077
cubic centimeters	cubic inches	0.061
cubic centimeters	fluid ounces	0.034
cubic inches	cubic centimeters	16.387
cubic meters	cubic yards	1.308
cubic yards	cubic meters	0.765
feet	meters	0.305
fluid ounces	cubic centimeters	29.57
gallons per acre	liters per hectare	9.3538
grains	milligrams	64.799
grams	grains	15.432
inches	centimeters	2.54
kilograms	pounds	2.205
kilometers	miles	0.621
kilometers per hour	miles per hour	0.62137
liters	quarts	1.057
meters	inches	39.37
miles	kilometers	1.609
miles per hour	kilometers per hour	1.6093
ounces (apothecary)	grams	31.103
ounces (avdp) per acre	grams per hectare	70.054
ounces (avdp) per gallon	grams per liter	7.4892
ounces (avoirdupois)	grams	28.35
ounces (fl) per acre	milliliters per hectare	73.079
ounces (fl) per gallon	milliliters per liter	7.8125
pounds (apothecary)	kilograms	0.373
pounds (avoirdupois)	kilograms	0.454
pounds per acre	kilograms per hectare	1.1209
pounds per gallon	kilograms per liter	0.11983
quarts	liters	0.946
square centimeters	square inches	0.155
square inches	square centimeters	6.452
square meters	square yards	1.196
square yards	square meters	0.836

Equivalents in Applying Soil Fumigants

Approximate Number of Row Feet/Acre at Given Distances between Rows

Distance between Rows (in)	Row Feet
18	29,040
24	21,780
30	17,424
36	14,520
42	12,446
48	10,890
54	9,680

Percentage Solution

Percent	Dilution or Rate	ppm	Grams/ liter
1	1:100	10,000	10
0.1	1:1,000	1,000	1
0.01	1:10,000	100	0.1
0.001	1:100,000	10	0.01
0.0001	1:1,000,000	1	0.001

1 part per million = by weight 1 milligram per kilogram, or by volume 1 microliter per liter

1 ounce in 7,500 gallons or 1 pound in 120,000 gallons is approximately 1 part per million by weight in water.

Rules of the Circle

To find circumference:
  Multiply diameter by 3.1416
  or
  Divide diameter by 0.3183.

To find diameter:
  Multiply circumference by 0.3183
  or
  Divide circumference by 3.1416.

To find radius:
  Multiply circumference by 0.15915
  or
  Divide circumference by 6.28318.

To find the side of an inscribed square:
  Multiply diameter by 0.7071
  or
  Multiply circumference by 0.2251
  or
  Divide circumference by 4.4428.

To find the side of an equal square:
  Multiply diameter by 0.8862
  or
  Divide diameter by 1.1284
  or
  Multiply circumference by 0.2821
  or
  Divide circumference by 3.546.

Square
  A side multiplied by 1.4142 equals the diameter of its circumscribing circle.
  A side multiplied by 4.443 equals the circumference of its circumscribing circle.
  A side multiplied by 1.128 equals the diameter of an equal circle.
  A side multiplied by 3.547 equals the circumference of an equal circle.
  Square inches multiplied by 1.273 equal circle inches of an equal circle.

To find the area of a circle:
  Multiply circumference by one-quarter of the diameter
  or
  Multiply the square of the diameter by 0.7854
  or
  Multiply the square of the circumference by 0.07958
  or
  Multiply the suqare of one-half the diameter by 3.1416.

To find the surface of a sphere or globe:
  Multiply the diameter by the circumference
  or
  Multiply the square of the diameter by 3.1416
  or
  Multiply 4 times the square of the radius by 3.1416.

Temperature Conversions and Equivalents

°F	°C	°F	°C	°F	°C
0	-17.78	80	26.67	158	70
10	-12.22	86	30	160	71.11
14	-10	90	32.22	170	76.67
20	-6.67	100	37.78	176	80
30	-1.11	104	40	180	82.22
32	0	110	43.33	190	87.78
40	4.44	120	48.89	194	90
50	10	122	50	200	93.33
60	15.56	130	54.44	210	98.89
68	20	140	60	212	100
70	21.11	150	65.56		

To change degrees Fahrenheit to degrees Celsius:
(Fahrenheit – 32) x 0.555.
Example: 86°F – 32 = 54 x 0.555 = 30°C.

Rate of Travel

Time to Travel 200 ft (sec)	Travel Rate (mi/hr)	Time to Travel 100 m (sec)	Travel Rate (km/hr)
136	1	360	1
91	1.5	240	1.5
68	2	180	2
55	2.5	144	2.5
46	3	120	3
39	3.5	103	3.5
34	4	90	4
30	4.5	80	4.5
27	5	72	5